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A cluster randomised controlled trial of an intervention based on the Health Action Process Approach for increasing fruit and vegetable consumption in Iranian adolescents

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Objective: To evaluate an intervention programme based on the Health Action Process Approach and designed to increase the intake of fruit and vegetables (F&V) among Iranian adolescents aged 13 to 18.

Design: A randomised controlled trial with three arms examined the short- (1 month) and long-term (6 months) effects of the intervention. There were two intervention groups (one included adolescents only [A group; $n = 510$]; the second included mothers and adolescents [M + A group; $n = 462$]) and a control group ($n = 483$). All participants were recruited from schools.

Main outcome measures: Social cognitions, self-regulatory processes and F&V intake.

Results: The intervention led to an increase in F&V intake for adolescents in the short and long terms. Adolescents in the M + A group increased their F&V intake more than adolescents in the A group. Outcome expectancies, self-monitoring, intentions, action and coping planning, perceived social support and behavioural automaticity mediated the effect of the intervention on F&V intake.

Conclusion: The theory-based intervention led to an increase in F&V intake and promoted more positive social cognitions and self-regulatory processes among Iranian adolescents. The findings also provide evidence that involving mothers in an intervention can confer additional benefit.

Keywords: adolescent; behaviour; fruit and vegetable; intervention; randomised-controlled trial

The benefits of consuming a sufficient amount of fruit and vegetables (F&V) are well documented: Eating F&V reduces the risk of obesity (National Health and Medical Research Council, 2013) and protects people from a variety of illnesses, such as

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cardiovascular disease, diabetes and cancers (Boeing et al., 2012; Lhakhang, Godinho, Knoll, & Schwarzer, 2014). It is therefore not surprising that dietary guidelines recommend that people consume plenty of F&V, including a variety of types and colours (National Health and Medical Research Council, 2013; Safavi et al., 2007; U.S. Department of Agriculture & U.S. Department of Health & Human Services, 2010). Although the benefits of eating F&V have been identified, most young people do not meet current guidelines for F&V intake. For example, surveys have suggested that less than 10% of 4 to 18-year-old children in Australia (Australian Bureau of Statistics, 2014), less than 1% of American adolescents aged 12 to 18 (Kimmons, Gillespie, Seymour, Serdula, & Blanck, 2009), 19% of adolescents aged 13–15 years in the Middle East (Al Ani, Al Subhi, & Bose, 2016) and only one third of the Iranian adolescents aged 12 to 15 (Shokrvash et al., 2013) consume sufficient F&V. Because insufficient F&V intake is likely to pose a serious public health burden, designing intervention programs that can effectively promote consumption of F&V is a priority for health care providers.

It is particularly important to promote F&V intake among adolescents for several reasons. First, adolescence is an important transition period in which health behaviours, including F&V intake, are subject to important changes (Kirk, Scott, & Daniels, 2005). For example, evidence suggests that adolescents are likely to decrease their intake of F&V and increase their intake of energy-dense, nutrient-poor foods (Neumark-Sztainer, Wall, Perry, & Story, 2003). Second, dietary behaviours established during adolescence may track into adulthood (te Velde, Twisk, & Brug, 2007), suggesting that any beneficial dietary changes made during adolescents may have long lasting benefits. Finally, adolescents may benefit from health education since adolescents possess the cognitive and behavioural competence(s) necessary to understand and act on health and behavioural instructions (Frenn, Malin, & Bansal, 2003).

There is increasing recognition that behavioural interventions should draw on theories of behaviour change (Michie, Johnston, Francis, Hardeman, & Eccles, 2008) for two main reasons: First, interventions are likely to be more effective if they target causal factors (i.e. determinants) of behaviour and behaviour change. Theories can provide insight into such determinants and, thus, point toward potential targets for intervention. Second, interventions that are based on theory (and that measure theoretically-specified mediators of intervention effects) can help to understand which specific techniques and approaches are effective and why. In so doing, such studies contribute to developing better theory (Michie et al., 2008).

The Health Action Process Approach

The Health Action Process Approach (HAPA) proposed by Schwarzer (2008) describes the factors that influence adoption and maintenance of health behaviours, including F&V intake (Godinho, Alvarez, Lima, & Schwarzer, 2015). The HAPA suggests that changing behaviour involves two consecutive phases: (1) a motivational phase in which factors such as perceptions of risk, outcome expectancies and self-efficacy are important; and (2) a self-regulatory phase in which factors such as action and coping planning are important. Risk perceptions reflect the individuals' assessment of their likelihood of encountering negative outcomes (e.g. the possibility and severity of harm from not eating F&Vs; Sheeran, Harris, & Epton, 2014). Although some researchers have found that perceptions of risk have a negligible impact on F&V intake (Schwarzer et al., 2007),

many studies suggest that risk perceptions have a significant, albeit relatively small, correlation with intention and behaviour and can influence behaviour, especially if coupled with specific recommendations on how to reduce the risk (for a review, see Sheeran et al., 2014). Outcome expectancies reflect the individuals' consideration of the pros and cons of performing the respective behaviour (Lhakhang et al., 2014; Schwarzer, 2008). Self-efficacy is the individuals' confidence in his/her ability to perform the intended behaviour (e.g. I am confident that I can eat more F&Vs; Bandura, 1997). The outcome of the motivational phase is a behavioural intention (e.g. I intend to eat more F&Vs).

The self-regulatory phase of the HAPA reflects the process of translating this intention into action; for example, by monitoring behaviour (self-monitoring; e.g. I monitor how I eat F&Vs) and by forming action and/or coping plans. Action planning refers to when, where and how to perform an intended behaviour, whereas coping planning indicates the anticipation of possible barriers and then the formation of plans specifying how to overcome them (Lin, Updegraff, & Pakpour, 2016; Pakpour, Hidarnia, Hajizadeh, & Plotnikoff, 2012). Once the person has made changes to their behaviour (e.g. started to eat more F&V) and is doing so regularly in similar situations (e.g. regularly having a side salad with an evening meal), the behaviour can become relatively automatic – that is, behavioural automaticity (Gardner, Abraham, Lally, & de Bruijn, 2012).

A number of interventions have successfully employed the HAPA with the aforementioned phases to promote changes in health behaviour(s), including F&V consumption (e.g. Adriaanse, Vinkers, de Ridder, Hox, & De Wit, 2011; Blanchette & Brug, 2005; Lange, Corbett, Lippke, Knoll, & Schwarzer, 2015). However, to our knowledge, no research to date has examined the use of an intervention based on the HAPA for promoting F&V consumption among adolescents; and certainly no research has examined the effects of such an intervention among East-Asian adolescents, despite there being a clear need to promote F&V consumption among this population (Shokrvash et al., 2013).

Augmenting the intervention to involve mothers

The HAPA is, arguably, quite an 'individual' approach, in that the model suggests that changing behaviour involves modifying an individual's social cognitions and/or self-regulatory processes, as described above. However, there is increasing recognition that family members are likely to have a substantial effect on dietary attitudes and behaviours among children and adolescents (e.g. Golan, Kaufman, & Shahar, 2006; Johannsen, Johannsen, & Specker, 2006; Pearson, Atkin, Biddle, & Gorely, 2010; Pearson, Biddle, & Gorely, 2008). Parents, especially mothers (Johannsen et al., 2006) can influence adolescents' attitudes toward food (Golan et al., 2006) and usually take care of the food for their children (e.g. select the food and prepare the meal). Therefore, interventions that attempt to improve adolescents' dietary behaviours might look to include mothers in the intervention programme. Indeed, a study found increased F&V intake among the daughters of mothers who received a self-regulation intervention (Gholami, Wiedemann, Knoll, & Schwarzer, 2015). However, to the best of our knowledge, no studies have examined whether involving mothers confers additional benefit over and above an effective intervention programme targeting F&V intake.

The present research

The present research aimed to evaluate the short- and long-term effects of two behavioural interventions based on the HAPA on F&V intake compared to a ‘no treatment’ control condition. The first intervention only targeted adolescents; while the second intervention also included mothers to investigate the incremental effects of involving family members in the intervention programme. In addition, we investigated whether changes in secondary outcomes (e.g. social cognitions and self-regulatory processes as specified by the HAPA) mediated the effects of the intervention on F&V intake.

Methods

Design

A prospective; cluster randomised controlled trial was conducted in which schools were randomly assigned into one of two experimental arms (the mother + adolescent [M + A] group or the adolescent [A] group) or a control arm. The research was conducted between September 2015 and March 2016 in compliance with the principles of Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of Qazvin University of Medical Sciences and the Organisation for Education at Qazvin and the trial was registered with the Clinical Trials Registry, ClinicalTrials.gov, under number NCT02405611.

Sample

A sample of high school students aged 13 to 18 years in Qazvin (a city near to Tehran) was recruited. Qazvin contains 2% of the population of Iran and has 73 high schools distributed between two educational districts. A list of high schools was provided by the Organisation for Education in Qazvin. Seven schools were excluded as they were already involved in a nutritional programme, which left 66 high schools as potential candidates for recruitment. Power analysis suggested that recruiting 464 participants at baseline in each group (i.e. 1392 participants in total) would provide 95% power to detect a medium-sized difference ($d = .40$) between the conditions in outcomes six months following the intervention, assuming a 10% drop-out rate and a design effect of 2.24. With an estimated average class size of 29, students from 48 schools (24 classes in boys only schools and 24 classes in girls only schools) were randomly selected from the 66 eligible schools and were invited to participate in the trial. A briefing session was convened to introduce the programme to the selected schools. All of the 48 schools that we approached agreed to participate in the trial and 1537 students from these schools were invited to take part in the trial, of which 1455 (94.7%) agreed to participate. Figure 1 shows the flow of schools and participants through the trial. Principals of the high schools that participated in the trial, along with the participants and (where applicable) their parents provided informed consent before participating.

Randomisation

After baseline assessment, the participating schools were randomly allocated into one of three arms of the trial (M + A, A and control) on an equal basis (i.e. 16 schools were

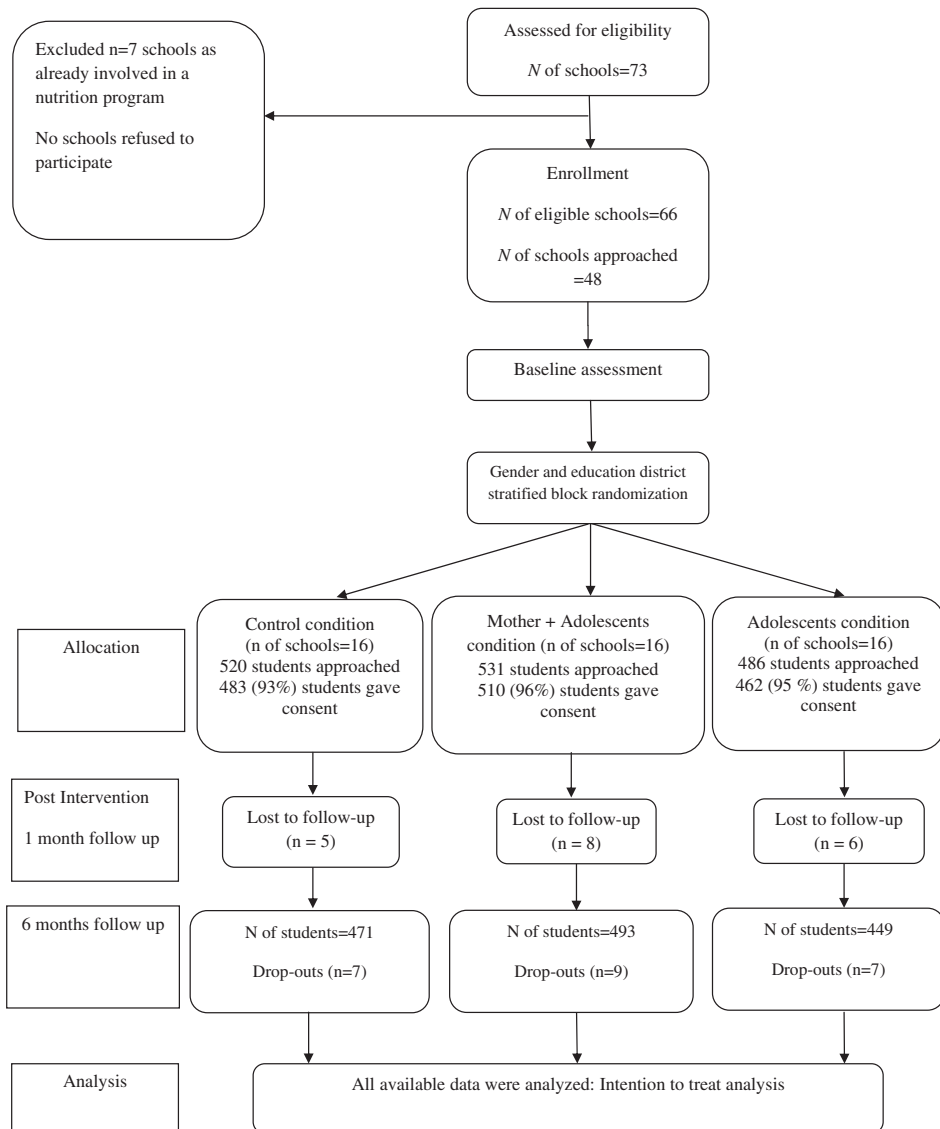


Figure 1. CONSORT trial flow chart.

allocated to each arm). The two educational districts in Qazvin have specific socioeconomic characteristics and there are no high schools with mixed genders in Iran. Therefore, to ensure equal distribution of socioeconomic characteristics and gender between the conditions, the clusters were stratified by educational district and gender of the students in the schools. An independent statistician used a computer-generated list of random numbers to randomise schools to the three arms. All research assistants and statisticians were blinded to group allocation.

Intervention

Effective intervention development involves selecting behaviour change techniques (or BCT's) to target the putative determinants of F&V intake, as specified by the relevant theoretical model (Adriaanse, Gollwitzer, de Ridder, de Wit, & Kroese, 2011; Verhoeven, Adriaanse, Evers, & de Ridder, 2012) – here, the HAPA (Schwarzer, 2008) and ideas around the involvement of family members in interventions designed to promote behaviour change (Pearson et al., 2008, 2010). Michie et al.'s (2013) taxonomy of BCT's was used to describe the BCT's employed by the current intervention (please see Supplementary Table 1 for detailed information).

Adolescents in both the M + A and A groups were invited to participate in a discussion (lasting around 20 minutes) on the importance of healthy diet and consuming at least five portions fruit and vegetables per day (targeting risk-perceptions, outcome-expectancies and intentions to consume F&Vs). Afterwards, a brochure, which was designed to target the psychosocial factors that influence F&V consumption according to the HAPA, was provided and adolescents were asked to complete it carefully. The first part of the brochure provided the World Health Organisation (WHO) recommendations that people should consume at least five portions of F&V daily. The potential risks of insufficient F&V intake (e.g. obesity and cardiovascular diseases) were described in order to influence participants' perceptions of risk.

The second part of the brochure contained a planning sheet, which guided adolescents to set goals and prepare them to change their behaviour. First, adolescents were asked to list the potential risks of insufficient F&V intake (targeting risk-perceptions). Then, they were asked to list the potential benefits of consuming at F&V (targeting outcome expectancies). One example of a potential benefit was given to participants: 'If I eat enough fruit and vegetables daily, then I will have a healthier life'. Next, adolescents were asked to think of two occasions in which they had prepared a nutritious and healthy meal (1) for their family and (2) for friends (targeting self-efficacy).

Table 1. Baseline characteristics by group.

	Control (<i>n</i> = 483)	Group Adolescent intervention (<i>n</i> = 510)	Mother + adolescent intervention (<i>n</i> = 462)	<i>p</i> -value for the comparison between conditions
<i>Age, years; M ± SD</i>	14.12 ± 2.35	14.62 ± 3.01	14.49 ± 3.24	.73
<i>Mother's education (years); M ± SD</i>	5.29 ± 1.54	5.70 ± 1.37	5.83 ± 1.93	.84
<i>Monthly household income in rials^a; M ± SD</i>	991.12 ± 304.40	981.63 ± 382.22	962.21 ± 321.61	.68
<i>Sex; <i>n</i> (%)</i>				.29
Male	246 (51%)	271 (53%)	222 (48%)	
Female	237 (49%)	239 (47%)	240 (52%)	
Number of classes	16	16	16	
Average number of students in the classes	30	32	29	

Note: SD = standard deviation.

^a3500 Rials = 1 U.S. Dollar, April 2016.

To promote action planning, participants were asked to create two plans specifying what (fruits or vegetables), when (day), which meal and time, with whom and where (place) they would eat F&V. Next, to promote coping planning, participants were asked to identify barriers that they might encounter when trying to increase their consumption of F&V and to generate strategies to overcome them. One example of a coping plan was given: 'If I run out of vegetables so I cannot make salad for lunch, then I will have a fruit at the end of my meal'. In an effort to prompt self-monitoring, participants received a calendar for a month and were asked to indicate the types and amount of F&V that they consumed each day.

Mothers in the M + A group were asked to participate in a single session on F&V intake. The schools that were involved in the research already invited parents to discuss their children's educational status on monthly basis. Therefore, the intervention session was held with mothers after one of these meetings. In the session, the importance of healthy diet, especially consuming sufficient F&V, was discussed for around 30 minutes. Afterwards, a brochure was provided to the mothers, which had a similar structure and content to that provided to the adolescents.

Measures

All participants completed measures of relevant constructs and behaviour at baseline, and again one month and six months after the intervention. The adolescents in the control group only received the questionnaires at the three assessment points without any intervention. The measures were developed specifically for the current study though they were similar to those used in previous studies (e.g. Godinho et al., 2015; Schwarzer, 2008), except for the measures of perceived social support and behavioural automaticity. Perceived social support was assessed using a scale developed by Erinosho et al. (2015) and behavioural automaticity was measured using the Self-Report Behavioural Automaticity Index (SRBAI; Gardner et al., 2012). F&V intake was considered to be the primary outcome and the measures of social cognitions (outcome expectancies, risk perceptions, self-efficacy, intention and perceived social support) and self-regulatory processes (self-monitoring, action planning, coping planning and behavioural automaticity) were considered to be secondary outcomes that could potentially mediate the impact of the intervention(s) on the primary outcome of F&V intake.

F&V intake

Two open-ended questions were used to assess participants' consumption of fruit and vegetables, respectively: 'How many servings of fruit (vegetables) do you eat on an average day?' The items were followed by a description of what constitutes a 'serving' of F&V (i.e. that one serving is equivalent to one handful of chopped apple or vegetables). The validity of the measure of F&V intake was assessed by means of an in-home interview with adolescents' parents because parents prepare the food for these adolescents and they should be able to accurately report the F&V intake of their children. Sixty-seven adolescents (which excluded those in the target population) were selected randomly and completed the measures of F&V intake. Afterwards, their parents were contacted for an interview. Two trained research assistants conducted the in-home interviews with the parents and asked them to report whether they have F&V in any form

(i.e. fresh, canned, jarred and frozen) at home. The level of agreement between parents' and adolescent's responses was fair (Cohen's kappa agreement was .65 for fruits and .68 for vegetables).

Perceived social support

Three items were used to measure perceived social support (e.g. 'My parents encourage me to eat fruit and vegetables'; Erinosho et al., 2015). Adolescents were asked to respond to all items on a six-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Outcome expectancies

Three items were used to measure outcome expectancies (e.g. that 'Eating five servings of fruit and vegetables a day would be good for my health') with responses provided on six-point scales ranging from 1 (strongly disagree) to 6 (strongly agree).

Risk perception

Risk perceptions were measured by two items (e.g. 'How likely do you think you are to ever get a severe disease, such as diabetes and cardiovascular disease?'). Adolescents were asked to respond on six-point Likert scales ranging from 1 (very unlikely) to 6 (very likely).

Self-efficacy

Three items were used to assess participants' self-efficacy (e.g. 'I am confident that I can eat five servings of fruit and vegetables a day'). Adolescents were asked to respond on a six-point Likert scale ranging from 1 (not at all true) to 6 (totally true).

Action planning

Action planning was measured with three items to which adolescents were asked to respond on a six-point Likert scale ranging from 1 (not at all true) to 6 (totally true). For example, 'I have already precisely planned when, where and how to eat five servings of fruit or vegetables throughout the day'.

Coping planning

Coping planning was assessed by four items that adolescents responded to on a six-point Likert scale ranging from 1 (not at all true) to 6 (totally true). For example, 'I already have concrete plans what to do in difficult situations in order to stick to my intentions'.

Intention

Intentions were measured using three items (e.g. ‘I intend to eat at least five servings of fruit and vegetables a day’) that adolescents were asked to respond to on six-point scales ranging from 1 (not at all true) to 6 (totally true).

Self-monitoring

Self-monitoring was measured with four items that were each rated on six-point scales ranging from 1 (not at all true) to 6 (totally true). For example, ‘I have consistently monitored when, how often, and how I eat F&V’.

Behavioural automaticity

Behavioural automaticity was assessed using the SRBAI (Gardner et al., 2012) with four items that assess the automaticity of behaviour. The stem ‘Eating fruit and vegetables is something ...’ was followed by (a) I do automatically, (b) I do without having to consciously remember, (c) I do without thinking and (d) I start doing before I realise that I am doing it. Respondents were asked to indicate the extent to which they agreed with each statement on a six-point Likert scale from 1 (strongly disagree) to 6 (strongly agree).

Data analysis

Demographic data and the outcome measures are reported using means and SDs for continuous variables; and using frequency and percentages for categorical variables. The internal consistency of each scale was examined using Cronbach’s α at each time point. Several multilevel linear mixed models with three levels (clustered in schools and repeated measures in person) were used to examine the efficacy of the intervention(s). The models accounted for the hierarchical nature of schools and repeated measures and a restricted iterative generalised least square (RIGLS) estimation was used to calculate unbiased estimates of the random parameters. Intention to treat analysis was used that analysed the data from all of the participants, regardless of whether they completed the intervention or not. Potentially confounding variables were identified using univariate multilevel analyses. Three potentially confounding variables (age, gender and mother’s level of education) were included in the linear mixed models as each had a p value $< .20$ in the univariate analyses. Multilevel mediation models (Krull & Mackinnon, 1999) were additionally used to examine whether the effects of the intervention(s) on F&V consumption at six months were mediated by social cognitions and self-regulatory processes assessed at one month.

Results

Randomisation check

Table 1 shows that the demographic characteristics of participants in the three groups were similar.

Effect of the intervention(s)

Table 2 shows the descriptive statistics for the primary and secondary outcome variables by time and group. Three-level linear mixed effects models (see Tables 2 and 3 in the Supplementary Online Materials) suggested that participants in both of the intervention groups significantly increased their intake of fruit ($B = 1.43$ [$p < .001$] for M + A; $B = .57$ [$p = .006$] for A) and vegetables ($B = .92$ [$p < .001$] for M + A; $B = .45$ [$p = .008$] for A) as compared with participants in the control group one month after the intervention.

Participants who received the interventions also had improved outcome expectancies ($B = .49$ [$p < .001$] for M + A; $B = .34$ [$p = .009$] for A), perceived themselves to be at more risk ($B = .57$ [$p = .004$] for M + A; $B = .36$ [$p = .046$] for A), had higher levels of self-efficacy ($B = .45$ [$p = .012$] for M + A; $B = .42$ [$p = .009$] for A), stronger intentions to eat F&V ($B = .83$ [$p < .001$] for M + A; $B = .54$ [$p < .001$] for A), were more likely to self-monitor their intake of F&V ($B = .98$ [$p < .001$] for M + A; $B = .33$ [$p = .006$] for A) and have formed action ($B = .83$ [$p < .001$] for M + A; $B = .45$ [$p = .012$] for A) and coping ($B = .95$ [$p < .001$] for M + A; $B = .55$ [$p = .001$] for A) plans, as compared with the participants in the control group one month after the intervention. The automaticity of behaviour did not significantly differ one month after the intervention between participants in the A group as compared with participants in the control group ($B = .17$ [$p = .059$]); however, it did significantly differ between participants in the M + A group and those in the control condition ($B = .69$ [$p < .001$]).

Similar differences were found between the participants in intervention and control conditions six months after the intervention. Specifically, there were differences between the conditions in fruit intake ($B = 1.63$ [$p < .001$] for M + A; $B = .58$ [$p < .001$] for A), vegetable intake ($B = 1.09$ [$p < .001$] for M + A; $B = .61$ [$p < .001$] for A), outcome expectancies ($B = .52$ [$p < .001$] for M + A; $B = .30$ [$p = .012$] for A), risk perceptions ($B = .70$ [$p < .001$] for M + A; $B = .33$ [$p = .031$] for A), self-efficacy ($B = .45$ [$p < .001$] for M + A; $B = .44$ [$p = .015$] for A), intentions ($B = .91$ [$p < .001$] for M + A; $B = .62$ [$p < .001$] for A), self-monitoring ($B = 1.07$ [$p < .001$] for M + A; $B = .43$ [$p = .004$] for A), action planning ($B = .88$ [$p < .001$] for M + A; $B = .49$ [$p = .007$] for A), coping planning ($B = 1.10$ [$p < .001$] for M + A; $B = .58$ [$p < .001$] for A) and the automaticity of behaviour ($B = .75$ [$p < .001$] for M + A; $B = .24$ [$p = .029$] for A).

We additionally compared outcomes between the two intervention groups (M + A and A groups) and found that participants in the M + A group had significantly better outcomes on all of the measures both one month (B [p] = .87 [$<.001$] for fruit intake; .47 [.013] for vegetable intake; .18 [$<.001$] for perceived social support; .29 [.038] for outcome expectancies; .29 [.016] for intention; .65 [$<.001$] for self-monitoring; .48 [$<.001$] for action planning; .40 [$<.001$] for coping planning; .52 [.004] for behavioural automaticity) and six months (B [p] = .86 [$<.001$] for fruit intake; .48 [.008] for vegetable intake; .26 [$<.001$] for perceived social support; .28 [.031] for outcome expectancies; .37 [.040] for risk perception; .30 [.032] for intention; .64 [$<.001$] for self-monitoring; .39 [.040] for action planning; .50 [.003] for coping planning; .58 [.004] for behavioural automaticity) after the intervention, except for risk perceptions one month after intervention (B [p] = .27 [.112]) and self-efficacy at both one month (B [p] = .08 [.467]) and six months (B [p] = .10 [.442]) after the intervention.

Table 2. Descriptive statistics for outcome measures by time and group.

Outcome measure	Group	Baseline	Reliability	Month 1	Reliability	Month 6	Reliability
Outcome expectancies	Control	<i>M</i> (SD) 4.90 (1.03)	α .89	<i>M</i> (SD) 4.81 (1.11)	α .84	<i>M</i> (SD) 4.74 (1.06)	α .86
	Adolescent	4.86 (1.04)		5.01 (1.10)		5.00 (.86)	
	Mother + adolescent Control	4.83 (.97)		5.21 (.96)		5.23 (.92)	
Risk perception	Control	3.33 (1.40)	.91	3.14 (1.61)	.88	3.09 (1.12)	.93
	Adolescent	3.42 (1.37)		3.54 (1.42)		3.56 (1.30)	
	Mother + adolescent Control	3.36 (1.43)		3.75 (1.47)		3.80 (1.43)	.79
Self-efficacy	Control	3.92 (1.38)	.93	3.83 (1.38)	.84	3.84 (.99)	
	Adolescent	3.81 (1.35)		4.15 (1.55)		4.16 (1.24)	
	Mother + adolescent Control	3.87 (1.40)		4.22 (1.58)		4.24 (1.28)	.85
Intention	Control	4.18 (1.08)	.89	3.93 (1.25)	.81	3.87 (1.16)	
	Adolescent	3.85 (1.22)		4.14 (1.16)		4.17 (.88)	
	Mother + adolescent Control	3.69 (1.41)		4.26 (1.13)		4.28 (1.09)	.80
Self-monitoring	Control	3.80 (1.21)	.84	3.82 (1.34)	.82	3.73 (.89)	
	Adolescent	3.60 (1.21)		3.95 (1.39)		3.99 (1.28)	

(Continued)

Table 2. (Continued).

Outcome measure	Group	Baseline	Reliability	Month 1	Reliability	Month 6	Reliability
Action planning	Mother + adolescent Control	3.68 (1.18)	.90	4.62 (1.46)	.85	4.68 (1.44)	.79
	Adolescent	4.29 (1.50)		4.39 (1.45)		4.34 (1.01)	
		4.26 (1.48)		4.76 (1.43)		4.80 (1.11)	
Coping planning	Mother + adolescent Control	4.21 (1.65)	.88	5.09 (1.28)	.82	5.13 (1.17)	.83
	Adolescent	3.44 (1.33)		3.45 (1.38)		3.36 (.84)	
		3.22 (1.26)		3.75 (1.33)		3.77 (1.31)	
SRBAI	Mother + adolescent Control	3.24 (1.49)	.84	4.16 (1.22)	.88	4.24 (1.05)	.82
	Adolescent	3.70 (1.47)		3.88 (1.29)		3.84 (.79)	
		3.46 (1.49)		3.80 (1.62)		3.83 (.88)	
Perceived social support	Mother + adolescent Control	3.43 (1.41)	.90	4.22 (1.26)	.79	4.31 (1.11)	.87
	Adolescent	2.47 (1.30)		2.22 (1.53)		2.18 (1.25)	
		2.27 (1.23)		2.29 (1.28)		2.28 (1.09)	
Fruit intake	Mother + adolescent Control	2.34 (1.15)	NA	3.74 (1.39)	NA	3.77 (1.34)	NA
	Adolescent	3.30 (1.65)		3.04 (1.18)		2.76 (1.24)	
		3.03 (1.46)		3.31 (1.06)		3.28 (1.18)	

(Continued)

Table 2. (Continued).

Outcome measure	Group	Baseline	Reliability	Month 1	Reliability	Month 6	Reliability
Vegetable intake	Mother + adolescent Control	3.42 (1.29)	NA	4.49 (1.16)	NA	4.47 (1.36)	NA
		2.17 (1.56)		2.08 (.96)		1.91 (.95)	
	Adolescent	2.00 (.99)		2.33 (1.02)		2.34 (1.09)	
	Mother + adolescent	2.11 (1.13)		2.89 (1.25)		2.92 (1.18)	

Note: SD = standard deviation; SRBAI = self-report behavioural automaticity index.

Mediation analyses

Outcome expectancies ($B [p] = .32 [.013]$), self-efficacy ($B [p] = .39 [.015]$), self-monitoring ($B [p] = .23 [.011]$), intention ($B [p] = .55 [.001]$) and action ($B [p] = .40 [.019]$) and coping planning ($B [p] = .45 [.003]$) mediated the effect of the A only intervention (relative to the control condition) on F&V intake at six months after the intervention. Outcome expectancies ($B [p] = .64 [.004]$), risk perception ($B [p] = .30 [.02]$), self-efficacy ($B [p] = .65 [.012]$), self-monitoring ($B [p] = 1.31 [<.001]$), intention ($B [p] = 1.03 [<.001]$), action planning ($B [p] = 1.24 [<.001]$), coping planning ($B [p] = 1.30 [<.001]$), behavioural automaticity ($B [p] = .97 [<.001]$) and perceived social support ($B [p] = .64 [<.001]$) mediated the effect of the M + A intervention (relative to the control condition) on F&V intake at six months after intervention. Self-monitoring ($B [p] = .36 [.006]$), intention ($B [p] = .12 [.016]$), action planning ($B [p] = .32 [.046]$), behavioural automaticity ($B [p] = .40 [.035]$) and perceived social support ($B [p] = .37 [.004]$) mediated the effect of the A only intervention (relative to the control condition) on F&V intake at six months after the intervention (see Table 4 of the supplementary online materials).

Discussion

Levels of F&V consumption in the present research were comparable to reports from other cities in Iran (e.g. Isfahan; Azadbakht & Esmailzadeh, 2012) and Tehran (Mirmiran, Azadbakht, & Azizi, 2007) and indicate that, like in many countries, F&V intake is typically lower than recommended and that children consume less F&V than adults (Lock, Pomerleau, Causer, Altmann, & McKee, 2005). Fortunately, the present research also found that an intervention based on the HAPA and targeting the putative psychosocial determinants of F&V intake served to increase adolescents' intake of F&V one month following the intervention. Furthermore, the effects were maintained and arguably even improved up to six months after the intervention. Although providing the intervention only to adolescents was effective, providing similar materials to the mothers of the adolescents as well conferred additional benefit. Mediation analyses suggested that the effect of the interventions on F&V consumption were mediated by factors specified by the HAPA; namely, social cognitions (perceptions of risk, outcome expectancies, intentions, perceived social support and self-efficacy) and self-regulatory processes (self-monitoring, action and coping planning and behavioural automaticity).

Our findings support those of other studies that suggest that planning is an effective way to help adolescents to change their health behaviours, including F&V intake (Adriaanse et al., 2011; Lhakhang et al., 2014; Verhoeven et al., 2012). However, evidence suggests that it is important to ensure that individuals are motivated before they are provided with volitional strategies and techniques (e.g. planning) to promote the translation of this motivation into health behaviour change (Schwarzer, 2008; Sheeran, Webb, & Gollwitzer, 2005; Weinstein & Sandman, 1992). With this in mind, the present intervention drew on the HAPA to identify the putative determinants of motivation (e.g. social cognitions such as perceptions of risk) and then incorporated techniques designed to motivate adolescents to eat more F&V (e.g. considering the pros and cons of eating more F&V), alongside volitional techniques such as action and coping planning.

A review of interventions designed to promote F&V consumption among 6 to 12-year old children concluded that outcome expectancies, self-efficacy and intentions can be increased using an intervention; and additionally influence F&V intake (Blanchette & Brug, 2005). In addition, interventions have been found to have positive effects on action and coping planning (Adriaanse, Vinkers, et al., 2011; Lange et al., 2015). However, to the best of our knowledge, the present research is the first to demonstrate effects of an intervention on outcome expectancies, risk perceptions, self-efficacy, intention, self-monitoring, action and coping planning and behavioural automaticity relating to F&V intake in adolescents aged between 13 and 18.

The finding that the augmented intervention, which also included a session with the mothers of the adolescents, conferred additional benefit also supports the findings of previous work that points to the importance of involving family members if trying to modify adolescents' dietary behaviour. For example, Gholami et al. (2015) randomised a sample of mothers to receive (vs. not) a leaflet describing techniques for encouraging children to eat vegetables. Consistent with the effects that we observed in the present research, the daughters of the mothers in the intervention group ate more vegetables after the intervention than before; as compared with the daughters of the mothers in the control group (see also Pearson et al., 2010; Tabak, Tate, Stevens, Siega-Riz, & Ward, 2012). However, the aforementioned studies only focused on mothers (or parents) receiving an intervention versus those not receiving intervention. In other words, their findings cannot tell us whether involving mothers in the intervention programme *together* with the adolescents has incremental effects. Our research provided this test and the findings support the idea that involving mothers can indeed confer additional benefits over and above delivering an intervention only to adolescents. Taken together then, health care providers may want to encourage mothers to get involved in intervention programmes designed to modify adolescents' dietary behaviours if possible.

Implications

The findings of the present research may help health care providers to design effective programmes to promote F&V intake among adolescents, and go some ways toward addressing the problems of insufficient F&V intake in this population (Australian Bureau of Statistics, 2014; Kimmons et al., 2009). Specifically, the present findings point to the importance of using theory to inform the design of interventions (Michie, Webb, & Sniehotta, 2010; Prestwich, Webb, & Conner, 2015) and involving family members (e.g. mothers) in such programmes. Although not tested in the present study, research on 'spill over effects' (Dolan & Galizzi, 2015) suggests that it is also possible that such programmes may encourage adolescents to engage in other health behaviours, such as doing physical activity and quitting smoking and drinking, in addition to making changes to the targeted behaviour (here, F&V consumption). Future research might, therefore, usefully measure the effects of similar interventions on a range of health behaviours. However, health care providers should also be mindful that compensatory health beliefs (Knäuper, Rabiau, Cohen, & Patriciu, 2004) could lead adolescents to use increases in F&V consumption to justify or 'license' engaging in more unhealthy behaviours (e.g. increasing alcohol consumption) (see also Taylor, Webb, & Sheeran, 2014; de Witt Huberts, Evers, & de Ridder, 2012, 2014).

Strengths and limitations

There are several strengths to the present research. First, participants were randomly allocated to conditions, and we compared the effectiveness of two interventions that differed in only one component (the involvement or not of mothers). Therefore, the effects of the intervention and also the incremental effects of involving mothers could be clearly identified. Second, the effects of the intervention(s) were measured in both the short and longer terms. Therefore, the findings provide health professionals with important insights into the effects of the intervention over six months. Third, our statistical analyses accounted for potential confounding variables, such as age and gender. To the best of our knowledge, this is the first study to examine the effects of an intervention based on the HAPA on the F&V intake of adolescents. Because previous studies examining the effects of such interventions on F&V intake only focus on adults, our findings provide health care providers with the confidence to develop and recommend similar interventions for adolescents aged between 13 and 18.

It is, however, also important to acknowledge some potential limitations to the present research. First, most of our outcome measures were developed specifically for the current study and have not been validated before. The psychometric properties of these measures would warrant thorough examination in subsequent research. F&V intake was measured using a retrospective, self-report measure, which is not ideal because of the potential for socially desirable responding and/or difficulties accurately remembering the relevant information. In addition, although we checked the correspondence between our measure and parents' reports of their adolescents' intake, we did not examine the test-retest reliability of our measure. Future studies may consider using a validated food frequency questionnaire or on-going behavioural assessments such as dietary logs (Kolar et al., 2005), especially if recorded by researchers or by objective means (e.g. shopping receipts) rather than by the participant themselves, in order to provide a more sensitive and reliable measure of F&V intake. We would like to note, however, that other research has supported the validity of self-report measures of F&V intake. For example, Harrington, Kohler, McClure, and Franklin (2009) found that 54% and 40% of fourth graders self-reports of fruit and vegetable consumption, respectively, matched observer's ratings. Another study showed that in a sample of 9- to 11-year-old children, their self-report of fruit consumption was 92% matched the dietary interview at the same day, and 89% in the previous day (Moore et al., 2007).

A second limitation is that the present findings may not be applicable to Western countries because of differences between Eastern and Western countries. In a sense, investigating the effects of a theory-based intervention in a developing, Eastern culture was one of the key contributions of our research. However, it is important to acknowledge that Eastern cultures, especially East Asian cultures, emphasise collectivism (Tsai, Strong, & Lin, 2015). Therefore, participants in our trial may have closer relationships with their mothers than adolescents in Western cultures do. As such, the promising effects of the M + A intervention may not be replicated in Western cultures, and future studies among Western samples are warranted.

Third, it is worth reiterating that participants in the present research were aged between 13 and 18. In a sense this was one of the aims of the present research (i.e. we wanted to intervene at a critical time, where adolescents are likely to be starting to make independent choices about the food that they eat and forming habits). However,

the findings may not generalise to children younger than 12 years of age who may have lower level of cognitive capacity (McRae et al., 2012) or young adults aged older than 18 years of age who may already have well-established habitual patterns of dietary behaviour (Anderson, 2004).

Finally, we would note that evidence suggests that home and school food environments can be important determinants of adolescents F&V intake (Pearson et al., 2008) and considering such environments in intervention programmes targeting F&V intake is encouraged (Pearson et al., 2010). Unfortunately, we did not consider this when we designed the present intervention programme. Future studies may therefore want to consider whether modifying home and / or school environments (e.g. to make F&V more accessible) would confer additional benefits over and above the BCTs employed in the present intervention.

Conclusion

The present findings suggest that an intervention incorporating BCTs designed to target the putative determinants of health behaviour, as specified by the HAPA, had promising effects on adolescents' intake of F&V. Furthermore, involving mothers in the intervention seemed to confer additional benefit. Therefore, we recommend that health care providers use theoretical models such as the HAPA to design programmes to help young people, including those in developing, Eastern cultures, to increase their F&V intake and also include family members who have the potential to influence the young person's diet.

Disclosure statement

No potential conflict of interest was reported by the authors.

Supplemental data

Supplemental data for this article can be accessed here: <https://doi.org/10.1080/08870446.2017.1341516>

References

- Adriaanse, M. A., Gollwitzer, P. M., de Ridder, D. T. D., de Wit, J. B. F., & Kroese, F. M. (2011). Breaking habits with implementation intentions: A test of underlying processes. *Personality and Social Psychology Bulletin*, 37, 502–513. doi:10.1177/0146167211399102
- Adriaanse, M. A., Vinkers, C. D. W., de Ridder, D. T. D., Hox, J. J., & De Wit, J. B. F. (2011). Do implementation intentions help to eat a healthy diet? A systematic review and meta-analysis of the empirical evidence. *Appetite*, 56, 183–193. doi:0.1016/j.appet.2010.10.012
- Al Ani, M. F., Al Subhi, L. K., & Bose, S. (2016). Consumption of fruits and vegetables among adolescents: A multi-national comparison of eleven countries in the Eastern Mediterranean Region. *British Journal of Nutrition*, 115, 1092–1099. doi:10.1017/S0007114515005371
- Anderson, N. B. (2004). *Encyclopedia of health and behavior*. Thousand Oaks, CA: Sage Publication.
- Australian Bureau of Statistics. (2014). *Australian health survey: Nutrition first results – Food and nutrients, 2011–12*. Canberra: Commonwealth of Australia.

- Azadbakht, L., & Esmailzadeh, A. (2012). Macro and micro-nutrients intake, food groups consumption and dietary habits among female students in Isfahan University of Medical Sciences. *Iranian Red Crescent Medical Journal*, 14, 204–209.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman.
- Blanchette, L., & Brug, J. (2005). Determinants of fruit and vegetable consumption among 6–12-year-old children and effective interventions to increase consumption. *Journal of Human Nutrition and Dietetics*, 18, 431–443. doi:10.1111/j.1365-277X.2005.00648.x
- Boeing, H., Bechthold, A., Bub, A., Ellinger, S., Haller, D., Kroke, A., ... Watzl, B. (2012). Critical review: Vegetables and fruit in the prevention of chronic diseases. *European Journal of Nutrition*, 51, 637–663. doi:10.1007/s00394-012-0380-y
- Dolan, P., & Galizzi, M. M. (2015). Like ripples on a pond: Behavioral spillovers and their implications for research and policy. *Journal of Economic Psychology*, 47, 1–16. doi:10.1016/j.joep.2014.12.003
- Erinosho, T. O., Pinard, C. A., Nebeling, L. C., Moser, R. P., Shaikh, A. R., Resnicow, K., ... Yaroch, A. L. (2015). Development and implementation of the National Cancer Institute's food attitudes and behaviors survey to assess correlates of fruit and vegetable intake in adults. *PLoS ONE*, 10, e0115017. doi:10.1371/journal.pone.0115017
- Frenn, M., Malin, S., & Bansal, N. K. (2003). Stage-based interventions for low fat diet with middle school students. *Journal of Pediatric Nursing*, 18, 36–45. doi:10.1053/jpdn.2003.6
- Gardner, B., Abraham, C., Lally, P., & de Bruijn, G.-J. (2012). Towards parsimony in habit measurement: Testing the convergent and predictive validity of an automaticity subscale of the self-report habit index. *International Journal of Behavioral Nutrition and Physical Activity*, 9, 102. doi:10.1186/1479-5868-9-102
- Gholami, M., Wiedemann, A., Knoll, N., & Schwarzer, R. (2015). Mothers improve their daughters' vegetable intake: A randomized controlled trial. *Psychology, Health, & Medicine*, 20, 1–7. doi:10.1080/13548506.2014.902485
- Godinho, C. A., Alvarez, M.-J., Lima, M. L., & Schwarzer, R. (2015). Health messages to promote fruit and vegetable consumption at different stages: A match-mismatch design. *Psychology & Health*, 30, 1410–1432. doi:10.1080/08870446.2015.1054827
- Golan, M., Kaufman, V., & Shahar, D. R. (2006). Childhood obesity treatment: Targeting parents exclusively vs. parents and children. *British Journal of Nutrition*, 95, 1008–1015. doi:10.1079/BJN20061757
- Harrington, K. F., Kohler, C. L., McClure, L. A., & Franklin, F. A. (2009). Fourth graders' reports of fruit and vegetable intake at school lunch: Does treatment assignment affect accuracy? *Journal of the American Dietetic Association*, 109, 36–44. doi:10.1016/j.jada.2008.10.006
- Johannsen, D. L., Johannsen, N. M., & Specker, B. L. (2006). Influence of parents' eating behaviors and child feeding practices on children's weight status. *Obesity*, 14, 431–439. doi:10.1038/oby.2006.57
- Kimmons, J., Gillespie, C., Seymour, J., Serdula, M., & Blanck, H. M. (2009). Fruit and vegetable intake among adolescents and adults in the United States: Percentage meeting individualized recommendations. *Medscape Journal of Medicine*, 11, 26.
- Kirk, S., Scott, B. J., & Daniels, S. R. (2005). Pediatric obesity epidemic: Treatment options. *Journal of the American Dietetic Association*, 105, S44–S51. doi:10.1016/j.jada.2005.02.013
- Knäuper, B., Rabiau, M., Cohen, O., & Patriciu, N. (2004). Compensatory health beliefs: Scale development and psychometric properties. *Psychology & Health*, 19, 607–624. doi:10.1080/0887044042000196737
- Kolar, A. S., Patterson, R. E., White, E., Neuhouser, M. L., Frank, L. L., Standley, J., ... Kristal, A. R. (2005). A practical method for collecting 3-day food records in a large cohort. *Epidemiology*, 16, 579–583. doi:10.1097/01.ede.0000165363.27323.ac

- Krull, J. L., & Mackinnon, D. P. (1999). Multilevel mediation modeling in group-based intervention studies. *Evaluation Review*, 23, 418–444. doi:[10.1177/0193841X9902300404](https://doi.org/10.1177/0193841X9902300404)
- Lange, D., Corbett, J., Lippke, S., Knoll, N., & Schwarzer, R. (2015). The interplay of intention, autonomy, and sex with dietary planning: A conditional process model to predict fruit and vegetable intake. *British Journal of Health Psychology*, 20, 859–876. doi:[10.1111/bjhp.12146](https://doi.org/10.1111/bjhp.12146)
- Lhakhang, P., Godinho, C., Knoll, N., & Schwarzer, R. (2014). A brief intervention increases fruit and vegetable intake. A comparison of two intervention sequences. *Appetite*, 82, 103–110. doi:[10.1016/j.appet.2014.07.014](https://doi.org/10.1016/j.appet.2014.07.014)
- Lin, C.-Y., Updegraff, J. A., & Pakpour, A. H. (2016). The relationship between the theory of planned behavior and medication adherence in patients with epilepsy. *Epilepsy & Behavior*, 61, 231–236. doi:[10.1016/j.yebeh.2016.05.030](https://doi.org/10.1016/j.yebeh.2016.05.030)
- Lock, K., Pomerleau, J., Causer, L., Altmann, D. R., & McKee, M. (2005). The global burden of disease attributable to low consumption of fruit and vegetables: Implications for the global strategy on diet. *Bulletin of the World Health Organization*, 83, 100–108.
- McRae, K., Gross, J. J., Weber, J., Robertson, E. R., Sokol-Hessner, P., Ray, R. D., ... Ochsner, K. N. (2012). The development of emotion regulation: an fMRI study of cognitive reappraisal in children, adolescents and young adults. *Social Cognitive and Affective Neuroscience*, 7, 11–22. doi:[10.1093/scan/nsr093](https://doi.org/10.1093/scan/nsr093)
- Michie, S., Johnston, M., Francis, J., Hardeman, W., & Eccles, M. (2008). From theory to intervention: Mapping theoretically derived behavioural determinants to behaviour change techniques. *Applied Psychology*, 57, 660–680. doi:[10.1111/j.1464-0597.2008.00341.x](https://doi.org/10.1111/j.1464-0597.2008.00341.x)
- Michie, S., Webb, T. L., & Sniehotta, F. F. (2010). The importance of making explicit links between theoretical constructs and behaviour change techniques. *Addiction*, 105, 1897–1898. doi:[10.1111/j.1360-0443.2010.03161.x](https://doi.org/10.1111/j.1360-0443.2010.03161.x)
- Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., ... Wood, C. E. (2013). The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: Building an international consensus for the reporting of behavior change interventions. *Annals of Behavioral Medicine*, 46, 81–95. doi:[10.1007/s12160-013-9486-6](https://doi.org/10.1007/s12160-013-9486-6)
- Mirmiran, P., Azadbakht, L., & Azizi, F. (2007). Dietary behaviour of Tehranian adolescents does not accord with their nutritional knowledge. *Public Health Nutrition*, 10, 879–901. doi:[10.1017/S1368980007246701](https://doi.org/10.1017/S1368980007246701)
- Moore, G. F., Tapper, K., Murphy, S., Clark, R., Lynch, R., & Moore, L. (2007). Validation of a self-completion measure of breakfast foods, snacks and fruits and vegetables consumed by 9- to 11-year-old schoolchildren. *European Journal of Clinical Nutrition*, 61, 420–430. doi:[10.1038/sj.ejcn.1602531](https://doi.org/10.1038/sj.ejcn.1602531)
- National Health and Medical Research Council. (2013). *Eat for health: Educators guide*. Canberra: Author.
- Neumark-Sztainer, D., Wall, M., Perry, C., & Story, M. (2003). Correlates of fruit and vegetable intake among adolescents: Findings from Project EAT. *Preventive Medicine*, 37, 198–208. doi:[10.1016/S0091-7435\(03\)00114-2](https://doi.org/10.1016/S0091-7435(03)00114-2)
- Pakpour, A. H., Hidarnia, A., Hajizadeh, E., & Plotnikoff, R. C. (2012). Action and coping planning with regard to dental brushing among Iranian adolescents. *Psychology, Health & Medicine*, 17, 176–187. doi:[10.1080/13548506.2011.596551](https://doi.org/10.1080/13548506.2011.596551)
- Pearson, N., Biddle, S. J., & Gorely, T. (2008). Family correlates of fruit and vegetable consumption in children and adolescents: A systematic review. *Public Health Nutrition*, 12, 267–283. doi:[10.1017/S1368980008002589](https://doi.org/10.1017/S1368980008002589)
- Pearson, N., Atkin, A. J., Biddle, S. J., & Gorely, T. (2010). A family-based intervention to increase fruit and vegetable consumption in adolescents: A pilot study. *Public Health Nutrition*, 13, 876–885. doi:[10.1017/S1368980010000121](https://doi.org/10.1017/S1368980010000121)

- Prestwich, A., Webb, T. L., & Conner, M. T. (2015). Using theory to develop and test interventions to promote changes in health behaviour: Evidence, issues, and recommendations. *Current Opinion in Psychology*, 5, 1–5. doi:[10.1016/j.copsyc.2015.02.011](https://doi.org/10.1016/j.copsyc.2015.02.011)
- Safavi, S. M., Omidvar, N., Djazayeri, A., Minaie, M., Hooshiarrad, A., & Sheikoleslam, R. (2007). Development of food-based dietary guidelines for Iran: A preliminary report. *Annals of Nutrition and Metabolism*, 51, 32–35. doi:[10.1159/000103565](https://doi.org/10.1159/000103565)
- Schwarzer, R. (2008). Modeling health behavior change. How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology*, 57, 1–29. doi:[10.1111/j.1464-0597.2007.00325.x](https://doi.org/10.1111/j.1464-0597.2007.00325.x)
- Schwarzer, R., Schüz, B., Ziegelmann, J. P., Lippke, S., Luszczynska, A., & Scholz, U. (2007). Adoption and maintenance of four health behaviors: Theory guided longitudinal studies on dental flossing, seat belt use, dietary behavior, and physical activity. *Annals of Behavioral Medicine*, 33, 156–166. doi:[10.1007/BF02879897](https://doi.org/10.1007/BF02879897)
- Sheeran, P., Webb, T. L., & Gollwitzer, P. M. (2005). The interplay between goal intentions and implementation intentions. *Personality and Social Psychology Bulletin*, 31, 87–98. doi:[10.1177/0146167204271308](https://doi.org/10.1177/0146167204271308)
- Sheeran, P., Harris, P. R., & Epton, T. (2014). Does heightening risk appraisals change people's intentions and behavior? A meta-analysis of experimental studies. *Psychological Bulletin*, 140, 511–543. doi:[10.1037/a0033065](https://doi.org/10.1037/a0033065)
- Shokrvash, B., Majlessi, F., Montazeri, A., Nedjat, S., Shojaezadeh, D., Rahimi, A., ... Saghaei-Asl, M. (2013). Fruit and vegetables consumption among adolescents: A study from a developing country. *World Applied Sciences Journal*, 21, 1502–1511. doi:[10.5829/idosi.wasj.2013.21.10.2920](https://doi.org/10.5829/idosi.wasj.2013.21.10.2920)
- Tabak, R. G., Tate, D. F., Stevens, J., Siega-Riz, A. M., & Ward, D. S. (2012). Family ties to health program: A randomized intervention to improve vegetable intake in children. *Journal of Nutrition Education and Behavior*, 44, 166–171. doi:[10.1016/j.jneb.2011.06.009](https://doi.org/10.1016/j.jneb.2011.06.009)
- Taylor, C., Webb, T. L., & Sheeran, P. (2014). “I deserve a treat!”: Justifications for indulgence undermine the translation of intentions into action. *British Journal of Social Psychology*, 53, 501–520. doi:[10.1111/bjso.12043](https://doi.org/10.1111/bjso.12043)
- Tsai, M.-C., Strong, C., & Lin, C.-Y. (2015). Effects of pubertal timing on deviant behaviors in Taiwan: A longitudinal analysis of 7th- to 12th-grade adolescents. *Journal of Adolescence*, 42, 87–97. doi:[10.1016/j.adolescence.2015.03.016](https://doi.org/10.1016/j.adolescence.2015.03.016)
- U.S. Department of Agriculture, & U.S. Department of Health and Human Services (2010). *Dietary guidelines for Americans, 2010* (7th ed.). Washington, DC: U.S. Government Printing Office.
- te Velde, S. J., Twisk, J. W., & Brug, J. (2007). Tracking of fruit and vegetable consumption from adolescence into adulthood and its longitudinal association with overweight. *British Journal of Nutrition*, 98, 431–438. doi:[10.1017/S0007114507721451](https://doi.org/10.1017/S0007114507721451)
- Verhoeven, A. A. C., Adriaanse, M. A., Evers, C., & de Ridder, D. T. D. (2012). The power of habits: Unhealthy snacking behaviour is primarily predicted by habit strength. *British Journal of Health Psychology*, 17, 758–770. doi:[10.1111/j.2044-8287.2012.02070.x](https://doi.org/10.1111/j.2044-8287.2012.02070.x)
- Weinstein, N. D., & Sandman, P. M. (1992). A model of the precaution adoption process: Evidence from home radon testing. *Health Psychology*, 11, 170–180. doi:[10.1037/0278-6133.11.3.170](https://doi.org/10.1037/0278-6133.11.3.170)
- de Witt Huberts, J. C., Evers, C., & de Ridder, D. T. D. (2012). License to sin: Self-licensing as a mechanism underlying hedonic consumption. *European Journal of Social Psychology*, 42, 490–496. doi:[10.1002/ejsp.861](https://doi.org/10.1002/ejsp.861)
- de Witt Huberts, J. C., Evers, C., & de Ridder, D. T. D. (2014). “Because I am worth it”: A theoretical framework and empirical review of a justification-based account of self-regulation failure. *Personality and Social Psychology Review*, 18, 119–138. doi:[10.1177/1088868313507533](https://doi.org/10.1177/1088868313507533)